

## Lab 1 - PPP

### Lab 1: WAN lab — Point-to-point protocol (PPP)

The physical topology is shown in Figure 18–1.

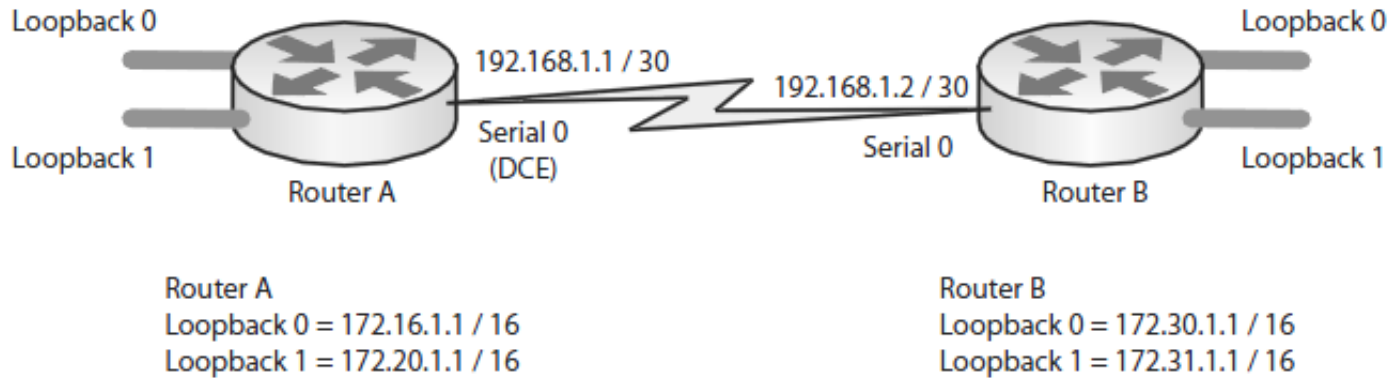


Figure 18–1: PPP lab

### Lab exercise

Your task is to configure the network in Figure 18–1 to allow full connectivity using the PPP (point-to-point protocol) of WAN. Please feel free to try the lab without following the lab walk-through section.

Text written in monospaced type indicates commands that can be entered on the router.

### Purpose

Not all networks run the default encapsulation of HDLC. Many companies use PPP, especially for ISDN connections. PPP is popular due to improved security features.

### Lab objectives

1. Use the IP-addressing scheme depicted in Figure 18–1. Router A needs to have a clock rate on interface serial 0: set this to 64000.
2. Set telnet access for the router to use the local login permissions of username “banbury” and the password “ccna”.
3. Configure the “enable password” to be “cisco”.
4. Configure PPP on the serial interface to provide connectivity to your neighbor. Enable CHAP authentication
5. Configure a default route to allow full IP connectivity.
6. Finally, test that the PPP link is up and working by sending a ping across the link.

### Lab walk-through

1. To set the IP addresses on an interface, you will need to do the following:

```
Router#config t
Router(config)#hostname RouterA
RouterA(config)#
RouterA(config)#interface serial 0
RouterA(config-if)#ip address 192.168.1.1 255.255.255.252
RouterA(config-if)#clock rate 64000
RouterA(config-if)#no shutdown
RouterA(config-if)#interface loopback 0
RouterA(config-if)#ip address 172.16.1.1 255.255.0.0
RouterA(config-if)#interface loopback 1
RouterA(config-if)#ip address 172.20.1.1 255.255.0.0
RouterA(config-if)# ^ Z
RouterA#
```

Router B:

```
Router#config t
Router(config)#hostname RouterB
RouterB(config)#
RouterB(config)#interface serial 0
RouterB(config-if)#ip address 192.168.1.2 255.255.255.252
RouterB(config-if)#no shutdown
RouterB(config-if)#interface loopback 0
RouterB(config-if)#ip address 172.30.1.1 255.255.0.0
RouterB(config-if)#interface loopback 1
RouterB(config-if)#ip address 172.31.1.1 255.255.0.0
RouterB(config-if)# ^ Z
RouterB#
```

To set the clock rate on a serial interface (DCE connection only) you need to use the “clock rate #” command on the serial interface, where # indicates the speed:

```
RouterA(config-if)#clock rate 64000
```

Ping across the serial link now .

2. To set PPP CHAP authentication, you need to set a username and password on each router. The username must match the hostname of the calling router exactly:

RouterA(config)#username RouterB password cisco « **Creates username and password for PPP CHAP**

Router B:

RouterB(config)#username RouterA password cisco

3. To set the “enable password,” do the following:

RouterA(config)#enable secret cisco « **Sets the “enable password” (encrypted)**

Router B, etc.:

RouterB(config)#enable secret cisco

4. We now need to configure PPP as the WAN link for this lab. To enable PPP, you will need to do the following:

RouterA(config)#interface serial 0

RouterA(config-if)#encapsulation ppp « **This will change the encapsulation type to be PPP.**

RouterA(config-if)#ppp authentication chap « **Use CHAP to authenticate.**

Router B:

RouterB(config)#interface serial 0

RouterB(config-if)#encapsulation ppp

RouterB(config-if)#ppp authentication chap

5. To configure a default route, there is one simple step (from configuration mode):

RouterA(config)#ip route 0.0.0.0 0.0.0.0 serial 0 « **For all unknown addresses, send the packet out of serial 0.**

Router B:

RouterB(config)#ip route 0.0.0.0 0.0.0.0 serial 0

6. To test the PPP connection, you will need to first check that the link is up. To do this use the "show interface" command:

```
RouterA#show interface serial 0
```

```
RouterA#show interface serial 0
```

```
Serial0 is up, line protocol is up
```

```
Hardware is HD64570
```

```
Internet address is 192.168.1.1/30
```

```
MTU 1500 bytes, BW 1544 Kbit, DLY 20000 usec,
```

```
reliability 255/255, txload 1/255, rxload 1/255
```

```
Encapsulation PPP, loopback not set
```

[Some output omitted...]

Router B:

```
RouterB#show interface serial 0
```

```
RouterB#show interface serial 0
```

```
Serial0 is up, line protocol is up
```

```
Hardware is HD64570
```

```
Internet address is 192.168.1.2/30
```

```
MTU 1500 bytes, BW 1544 Kbit, DLY 20000 usec,
```

```
reliability 255/255, txload 1/255, rxload 1/255
```

```
Encapsulation PPP, loopback not set
```

```
LCP Open
```

```
Open: IPCP, CDPCP
```

Make sure that serial 0 is up and the line protocol is up.

Next, ping your neighbor's serial interface: this will test if the link is up:

```
RouterA#ping 192.168.1.2
```

Type escape sequence to abort.

Sending 5, 100-byte ICMP Echos to 192.168.1.2, timeout is 2 seconds:

!!!!

Success rate is 100 percent (5/5), round-trip min/avg/max = 28/31/32 ms

Router B:

RouterB#ping 192.168.1.1

If everything is OK, you will receive five replies and have a 100 percent success rate.

Type escape sequence to abort.

Sending 5, 100-byte ICMP Echos to 192.168.1.1, timeout is 2 seconds:

!!!!

Success rate is 100 percent (5/5), round-trip min/avg/max = 28/31/32 ms

7. To test the PPP negotiation, you can shut the serial interface and then no shut it with the “debug ppp authentication” and “debug ppp negotiation” commands on. You can see the CHAP challenge taking place and the line coming up as you read the debug.

RouterB#config t

RouterB(config)#debug ppp authentication

RouterB(config)#debug ppp authentication

RouterB(config)#interface s0

RouterB(config-if)#shut

RouterB(config-if)#

01:41:37: %LINK-5-CHANGED: Interface Serial0, changed state to  
administratively down

RouterB(config-if)#

01:41:37: Se0 IPCP: Remove link info for cef entry 192.168.1.1

01:41:37: Se0 IPCP: State is Closed

01:41:37: Se0 CDPCP: State is Closed

01:41:37: Se0 PPP: Phase is TERMINATING

01:41:37: Se0 LCP: State is Closed

01:41:37: Se0 PPP: Phase is DOWN

01:41:37: Se0 IPCP: Remove route to 192.168.1.1

RouterB(config-if)#

01:41:38: %LINEPROTO-5-UPDOWN: Line protocol on Interface Serial0,

changed state to down

RouterB(config-if)#no shut

RouterB(config-if)# ^Z

RouterB#

01:41:46: %SYS-5-CONFIG\_I: Configured from console by console

01:41:46: %LINK-3-UPDOWN: Interface Serial0, changed state to up

01:41:46: Se0 PPP: Treating connection as a dedicated line

01:41:46: Se0 PPP: Phase is ESTABLISHING, Active Open

01:41:46: Se0 PPP: Authorization NOT required

01:41:46: Se0 LCP: O CONFREQ [Closed] id 184 len 15

01:41:46: Se0 LCP: AuthProto CHAP (0x0305C22305)

01:41:46: Se0 LCP: MagicNumber 0x093B9E12 (0x0506093B9E12)

01:41:46: Se0 LCP: I CONFREQ [REQsent] id 84 len 15

01:41:46: Se0 LCP: AuthProto CHAP (0x0305C22305)

01:41:46: Se0 LCP: MagicNumber 0x00698D38 (0x050600698D38)

01:41:46: Se0 LCP: O CONFACK [REQsent] id 84 len 15

01:41:46: Se0 LCP: AuthProto CHAP (0x0305C22305)

01:41:46: Se0 LCP: MagicNumber 0x00698D38 (0x050600698D38)

01:41:48: Se0 LCP: TIMEout: State ACKsent

01:41:48: Se0 LCP: O CONFREQ [ACKsent] id 185 len 15

01:41:48: Se0 LCP: AuthProto CHAP (0x0305C22305)

01:41:48: Se0 LCP: MagicNumber 0x093B9E12 (0x0506093B9E12)

01:41:48: Se0 LCP: I CONFREQ [ACKsent] id 85 len 15

01:41:48: Se0 LCP: AuthProto CHAP (0x0305C22305)

01:41:48: Se0 LCP: MagicNumber 0x00698D38 (0x050600698D38)

01:41:48: Se0 LCP: O CONFACK [ACKsent] id 85 len 15

01:41:48: Se0 LCP: AuthProto CHAP (0x0305C22305)

01:41:48: Se0 LCP: MagicNumber 0x00698D38 (0x050600698D38)

01:41:48: Se0 LCP: I CONFACK [ACKsent] id 185 len 15

01:41:48: Se0 LCP: AuthProto CHAP (0x0305C22305)

01:41:48: Se0 LCP: MagicNumber 0x093B9E12 (0x0506093B9E12)

01:41:48: Se0 LCP: State is Open

01:41:48: Se0 PPP: Phase is AUTHENTICATING, by both

01:41:48: Se0 CHAP: O CHALLENGE id 180 len 28 from "RouterB"

01:41:48: Se0 CHAP: I CHALLENGE id 180 len 28 from "RouterA"  
01:41:48: Se0 PPP: Sent CHAP SENDAUTH Request to AAA  
01:41:48: Se0 CHAP: I RESPONSE id 180 len 28 from "RouterA"  
01:41:48: Se0 PPP: Phase is FORWARDING, Attempting Forward  
01:41:48: Se0 PPP: Phase is AUTHENTICATING, Unauthenticated User  
01:41:48: Se0 PPP: Sent CHAP LOGIN Request to AAA  
01:41:48: Se0 PPP: Received SENDAUTH Response from AAA = PASS  
01:41:48: Se0 CHAP: O RESPONSE id 180 len 28 from "RouterB"  
01:41:48: Se0 PPP: Received LOGIN Response from AAA = PASS  
01:41:48: Se0 PPP: Phase is FORWARDING, Attempting Forward  
01:41:48: Se0 PPP: Phase is AUTHENTICATING, Authenticated User  
01:41:48: Se0 CHAP: O SUCCESS id 180 len 4  
01:41:48: Se0 CHAP: I SUCCESS id 180 len 4  
01:41:48: Se0 PPP: Phase is UP  
01:41:48: Se0 IPCP: O CONFREQ [Closed] id 2 len 10  
01:41:48: Se0 IPCP: Address 192.168.1.2 (0x0306C0A80102)  
01:41:48: Se0 CDPCP: O CONFREQ [Closed] id 2 len 4  
01:41:48: Se0 CDPCP: I CONFREQ [REQsent] id 2 len 4  
01:41:48: Se0 CDPCP: O CONFACK [REQsent] id 2 len 4  
01:41:48: Se0 CDPCP: I CONFACK [ACKsent] id 2 len 4  
01:41:48: Se0 CDPCP: State is Open  
01:41:48: Se0 IPCP: I CONFREQ [REQsent] id 2 len 10  
01:41:48: Se0 IPCP: Address 192.168.1.1 (0x0306C0A80101)  
01:41:48: Se0 IPCP: O CONFACK [REQsent] id 2 len 10  
01:41:48: Se0 IPCP: Address 192.168.1.1 (0x0306C0A80101)  
01:41:48: Se0 IPCP: I CONFACK [ACKsent] id 2 len 10  
01:41:48: Se0 IPCP: Address 192.168.1.2 (0x0306C0A80102)  
01:41:48: Se0 IPCP: State is Open  
01:41:48: Se0 IPCP: Install route to 192.168.1.1  
01:41:48: Se0 IPCP: Add link info for cef entry 192.168.1.1  
01:41:49: %LINEPROTO-5-UPDOWN: Line protocol on Interface Serial0,  
changed state to up  
RouterB#un all

All possible debugging has been turned off

## Show runs

RouterA#show run

Building configuration...

Current configuration : 739 bytes

!

version 12.1

service timestamps debug uptime

service timestamps log uptime

no service password-encryption

!

hostname RouterA

!

enable secret 5 \$1\$jjQo\$YJXxLo.EZm9t6Sq4UYeCv0

!

username RouterB password cisco

!

ip subnet-zero

!

interface Loopback0

ip address 172.16.1.1 255.255.0.0

!

interface Loopback1

ip address 172.20.1.1 255.255.0.0

!

interface Serial0

ip address 192.168.1.1 255.255.255.252

encapsulation ppp

ppp authentication chap

clockrate 64000

!

interface Serial1

no ip address

shutdown

!



```
interface Ethernet0
  no ip address
  shutdown
!
interface BRI0
  no ip address
  shutdown

!
ip classless
ip route 0.0.0.0 0.0.0.0 Serial0
no ip http server
!
line con 0
line aux 0
line vty 0 4
  login local
!
end
```

RouterA#

---

RouterB#show run

Building configuration...

Current configuration : 721 bytes

!

version 12.1

service timestamps debug uptime

service timestamps log uptime

no service password-encryption

!

hostname RouterB

```
!  
enable secret 5 $1$HrXN$ThpIDHEZdnCbbeA/Ie67E1  
!  
username RouterA password cisco  
!  
ip subnet-zero  
!  
interface Loopback0  
ip address 172.30.1.1 255.255.0.0  
!  
interface Loopback1  
ip address 172.31.1.1 255.255.0.0  
!  
interface Ethernet0  
no ip address  
shutdown  
!  
interface Serial0  
ip address 192.168.1.2 255.255.255.252  
encapsulation ppp  
ppp authentication chap  
!  
interface Serial1  
no ip address  
shutdown  
  
!  
interface BRI0  
no ip address  
shutdown  
!  
ip classless  
ip route 0.0.0.0 0.0.0.0 Serial0  
no ip http server  
!
```

```
line con 0
line aux 0
line vty 0 4
login local
!
end
RouterB#
```



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